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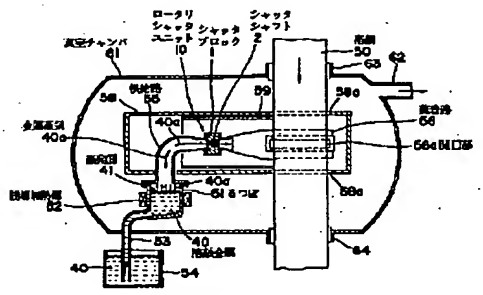
(54) VACUUM DEPOSITION DEVICE

(57) Abstract:

PROBLEM TO BE SOLVED: To enable the fine adjustment of the flow rate of metallic vapor and to obtain metallic coating having certain required coating thickness, in a device in which metallic coating is vacuum-deposited on the running strip material to be vacuum-deposited, by rotating a shutter shaft of a rotary shutter unit.

SOLUTION: In a shutter block 1, a shaft rotary hole in the horizontal direction orthogonal to the direction of the passage of metallic vapor 40a and a vapor passage hole piercing orthogonally thereto are bored. Into this shaft rotary hole, a shutter shaft 2 in which flow rate adjusting holes respectively with different diameters are bored in an arrangement in which the adjustment of the flow rates are continuously made possible is rotatably inserted to compose a rotary shutter unit 10. The inside of a heat insulating box 58 is heated by a heater 59, the inside of a vacuum chamber 61 is evacuated from an exhaust pipe 62, and molten metal 40 in a melting furnace 54 is sucked up to a crucible 51 and is heated by an induction heater 52 to evaporate the metallic vapor 40a, which is fed to a vapor depositing path 56 while its flow rate is finely adjusted by the rotary shutter unit 10.



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CLAIMS

[Claim(s)]
[Claim 1] The vacuum evaporation system characterized by infixing in the metallic-fumes evaporation side of the metal evaporation tub in a vacuum chamber, and the band material vacuum evaporationo section the rotary shutter unit characterized by providing the following, and changing. The shutter block which drilled the steamy circulation hole which intersects perpendicularly with this shaft rotation hole, and is penetrated while drilling a shaft rotation hole in the metallic-fumes circulation direction and the direction which intersects perpendicularly. The shutter shaft which drilled the aforementioned steamy circulation hole and the steamy flow control hole which can be engaged, and was fitted in the aforementioned shaft rotation hole possible [rotation].
[Claim 2] The vacuum evaporation system characterized by infixing in the metallic-fumes evaporation side of the metal evaporation tub in a vacuum chamber, and the band material vacuum evaporationo section the rotary shutter unit which consists of the shutter shaft which put in order and drilled two or more steamy flow control holes from which a path differs at the aforementioned shutter shaft in a minor diameter in shaft orientations, and the aforementioned shutter block, and consisting of the steamy flow control hole of a major diameter, and the steamy flow control hole of this major diameter in a claim 1.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to the vacuum evaporationo-ed band material it runs at the vacuum evaporation system which carries out vacuum evaporationo plating of the metal coat by the abbreviation vacua.
[0002]
[Description of the Prior Art] The conventional vacuum evaporation system is explained based on drawing 8 . The longitudinal section of the conventional vacuum evaporation system is shown in drawing 8 .
[0003] In drawing 8 , 51 is a crucible, the circumference of a crucible 51 is equipped with an induction heater 52, and the interior of the crucible 51 is carried out to the vacuum chamber 61. The band steel carrying-in way 63, the band steel taking-out way 64, and the exhaust pipe 62 are formed in the vacuum chamber 61. Moreover, a fusion furnace 54 is arranged in the external lower part of the vacuum chamber 61, and the fusion furnace 54 is connected to the jar 51 through the siphon 53 which penetrates the vacuum chamber 61.
[0004] 58 is a heat insulation box, slit 58a which band steel 50 passes is drilled in the upper surface and the inferior surface of tongue of the heat insulation box 58, and the interior of the heater 59 is carried out to the heat insulation box 58. And the interior of the heat insulation box 58 is carried out to the vacuum chamber 61. Moreover, 56 is a vacuum evaporationo way, it is divided into two forks so that the vacuum evaporationo way 56 may turn into a run way of band steel 50 and opening 56a may counter, and the interior of the vacuum evaporationo way 56 is carried out to the heat insulation box 58. 30 is a shutter unit, the shutter unit 30 consists of the shutter block 31 and the shutter board 32, and the shutter unit 30 is infixed in the supply pipe 55 and the vacuum evaporationo way 56 which were connected above the metal evaporation side 41 of the jar 51 which has penetrated the heat insulation box 58.
[0005] For example, while dissolving metals, such as Mg or Zn, in molten metal 40 with a fusion furnace 54, the inside of the heat insulation box 58 is heated with a heater 59, and the inside of the vacuum chamber 61 is attracted from an exhaust pipe 62, for example, it decompresses to the abbreviation vacua of 10-3torr. The molten metal 40 in a fusion furnace 54 is sucked up from the siphon 53 to a crucible 51 according to the atmospheric pressure difference of the interior of this vacuum chamber 61, and the exterior. Heat molten metal 40 to necessary temperature by the induction heater 52, and metallic-fumes 40a is evaporated. Making it go up and down the shutter board 32 within the shutter block 31, adjusting the opening, and adjusting the flow rate of metallic-fumes 40a, the vacuum evaporationo way 56 is supplied from a supply pipe 55 and a shutter 57, and it is made to breathe out from both opening 56a. And rather than metallic-fumes 40a, low-temperature band steel 50 is run between both openings from slit 58a of the band steel carrying-in way 63 and the heat insulation box 58, the vacuum evaporationo of the metallic-fumes 40a is carried out to the both sides, and it takes out from the band steel taking-out way 64.
[0006]
[Problem(s) to be Solved by the Invention] In the conventional vacuum evaporation system, since you make it go up and down the shutter board 32 and the opening of the shutter unit 30 is adjusted as shown in drawing 8 , the detailed flow control in the minute flow rate region of metallic-fumes 40a

is especially difficult. Therefore, since fine tuning of the metal coating thickness of band steel 50 by which vacuum evaporationo is carried out among opening 56a of both vacuum evaporationo ways 56 cannot be performed, the quality will deteriorate.
[0007]
[Means for Solving the Problem] The shutter block which drilled the steamy circulation hole which intersects perpendicularly with this shaft rotation hole, and is penetrated while the composition of this invention for solving the above-mentioned technical problem drilled the shaft rotation hole in the metallic-fumes circulation direction and the direction which intersects perpendicularly, It is characterized by infixing in the metallic-fumes evaporation side of the metal evaporation tub in a vacuum chamber, and the band material vacuum evaporationo section the rotary shutter unit which consists of the shutter shaft which drilled the aforementioned steamy circulation hole and the steamy flow control hole which can be engaged, and was fitted in the aforementioned shaft rotation hole possible [rotation], and changing.
[0008] And it is characterized by infixing in the metallic-fumes evaporation side of the metal evaporation tub in a vacuum chamber, and the band material vacuum evaporationo section the rotary shutter unit which consists of the shutter shaft which put in order and drilled two or more steamy flow control holes where paths differ in shaft orientations, and the aforementioned shutter block, and changing from the steamy flow control hole of a major diameter, and the steamy flow control hole of this major diameter to the aforementioned shutter shaft in a minor diameter.
[0009]
[Embodiments of the Invention] Decompress the inside of a vacuum chamber to an abbreviation vacuum, and metallic fumes are evaporated from the molten-metal evaporation side in a metal evaporation tub. While rotating the shutter shaft of a rotary shutter unit by the necessary angle of rotation and making the steamy flow control hole and the steamy circulation hole of a shutter block engaged, the effective-area product is adjusted. The metal coat of the necessary thickness whose thickness tuned the flow rate of metallic fumes finely, supplied the band material vacuum evaporationo section, carried out vacuum evaporationo to the band material it runs, and was fixed is formed.
[0010] Moreover, the metal coat of the necessary thickness whose thickness fine-adjusted the effective-area product while making each steamy flow control hole which rotated the shutter shaft by the necessary angle of rotation, and was arranged in the major-diameter steamy flow control hole and the shutter shaft, and each steamy circulation hole of a shutter block engaged, tuned the flow rate of metallic fumes finely further, supplied the band material vacuum evaporationo section, carried out vacuum evaporationo to the band material it runs, and was further fixed is formed.
[0011]
[Example] In the longitudinal section of the vacuum evaporation system which starts the 1st example of this invention at drawing 1 , the longitudinal section which expanded the rotary shutter unit in drawing 1 to drawing 2 , and drawing 3 , it is III-III of drawing 2 . The diagram showing the operation explanation of a rotary shutter unit rate [drawing 4 / a line view state and] / of a flow rate of the angle of rotation of a shutter shaft and metallic fumes according to an experiment in drawing 5 is shown. In addition, the explanation which gives the same sign to the same conventional member and same conventional part as a vacuum evaporation system, and overlaps is omitted.
[0012] In drawing 1 , the supply way 55 is arranged above the metal evaporation side 41 of the molten metal 40 in a crucible 51, and the rotary shutter unit 10 is infixed in this supply way 55 and the vacuum evaporationo way 56.
[0013] In drawing 2 and drawing 3 , 1 is a shutter block and is drilled in horizontally the shutter block 1 and shaft rotation hole 1a cross at right angles with the circulation direction of metallic-fumes 40a in the supply way 55 and the vacuum evaporationo way 56. While close gutter 1b and appearance gutter 1c are horizontally engraved on the shutter block 1, 1d of two or more steamy circulation holes which come out with close gutter 1b, and connect gutter 1c penetrates shaft rotation hole 1a, and they are drilled.
[0014] 2 is a shutter shaft and the flow control holes (the bore of 30mm, 28mm, 24mm, and 20mm) 2a, 2b, 2c, and 2d where paths differ, respectively are drilled by the shutter shaft 2 by arrangement like drawing 5 whose flow control is attained continuously. The shutter shaft 2 is fitted in shaft

rotation hole 1a possible [rotation]. The rotary shutter unit 10 is constituted by this shutter block 1 and the shutter shaft 2.

[0015] Other composition is the same as that of the vacuum evaporation system shown in drawing 8 . An operation of the vacuum evaporation system mentioned above is explained.

[0016] As shown in drawing 1 , it heats with a heater 59 in the heat insulation box 58, and by the vacuum aspirator which is not illustrated from an exhaust pipe 62, the inside of the vacuum chamber 61 is attracted and the inside of the vacuum chamber 61 is decompressed to the abbreviation vacua of for example, 10-3torr. The molten metal 40 in a fusion furnace 54 is sucked up in a crucible 51 from the siphon 53 according to the atmospheric pressure difference of the interior of the vacuum chamber 61, and the exterior, it heats by the induction heater 52 and metallic-fumes 40a is evaporated, and while the rotary shutter unit 10 adjusts the flow rate, the vacuum evaporationo way 56 divided into two forks from the supply pipe 55 is supplied.

[0017] And it is made to run the low-temperature band steel 50 rather than metallic-fumes 40a among opening 56a of the both sides which are breathing out metallic-fumes 40a, the vacuum evaporationo of the metallic-fumes 40a is carried out to band steel 50, and the metal coat of necessary thickness is formed.

[0018] The state where the rotary shutter unit 10 was completely made close is shown in drawing 2 and drawing 3 . If the shutter shaft 2 is rotated for the flow control holes 2a, 2b, 2c, and 2d to drawing as a two-dot chain line shows, the degree of shutter opening will be in the state of full open. Moreover, it rotates by the angle of rotation theta of 30 degrees from the position of full open of the shutter shaft 2, and 2d is made engaged by 1d of steamy circulation holes, the flow control holes 2a, 2b, and 2c, and necessary opening, as shown in drawing 4 .

[0019] And vacuum evaporationo is carried out to the band steel 50 rotates the shutter shaft 2 at a minute angle, fine-adjusts an each flow control holes [2a, 2b, 2c, and 2d] effective-area product, tunes the flow rate of metallic-fumes 40a finely, and supplies to the vacuum evaporationo way 56, and it runs by making metallic-fumes 40a breathe out from opening by the thickness of the metal fine film of the band steel 50 by which vacuum evaporationo is carried out. Thus, it becomes possible to form the metal coat of the necessary thickness whose thickness was fixed by carrying out minute rotation of the shutter shaft 2, and tuning the flow rate of metallic-fumes 40a finely.

[0020] The effective-area product ratio of the rotary shutter unit 10 in each angle of rotation theta which is an experimental result in the state where it heated at the ordinary temperature of the shutter block 1 and the shutter shaft 2 and 700 degrees C, and the rate of a flow rate of metallic-fumes 40a are shown in drawing 5 .

[0021] The 2nd example of this invention is explained based on drawing 6 and drawing 7 . In the longitudinal section of the rotary shutter unit of the vacuum evaporation system which starts the 2nd example of this invention at drawing 6 , and drawing 7 , it is VII-VII in drawing 6 . The line view state is shown.

[0022] The example of illustration drills 11d of each steamy circulation holes which intersect perpendicularly with the circulation direction of metallic-fumes 40a in the supply way 55 of the shutter block 11, and the vacuum evaporationo way 56 and which penetrate shaft rotation hole 11a horizontally while drilling shaft rotation hole 11a horizontally, omits close gutter 1b of the 1st example, and appearance gutter 1c, and simplifies the structure. Other composition is the same as that of the 1st example.

[0023] According to the composition mentioned above, it becomes possible to form the metal coat of the necessary thickness whose thickness was fixed by rotating the shutter shaft 2, making those the each holes 2a-2d of flow control, and 11d of vertical circulation holes engaged, carrying out minute rotation of the shutter shaft 2, and tuning the flow rate of metallic-fumes 40a finely.

[0024]

[Effect of the Invention] In the vacuum evaporation system of this invention, the flow rate of the metallic fumes supplied to the band material vacuum evaporationo section can be finely tuned by rotating a shutter shaft by the minute angle of rotation, and fine-adjusting the effective-area product of a steamy circulation hole and a steamy flow control hole. Consequently, it can become possible to maintain the flow rate of fixed metallic fumes, the vacuum evaporationo of the metal coat of the processing thickness whose thickness was fixed can be carried out to band material, and the quality

can be improved.
[0025] moreover, in the vacuum evaporation system of this invention By rotating the shutter shaft which drilled two or more steamy flow control holes where the paths arranged in the shutter shaft in the minor diameter differ at a minute angle, and adjusting still more minutely the effective-area product of a steamy circulation hole and a steamy flow control hole rather than the steamy flow control hole of a major diameter, and the steamy flow control hole of this major diameter The flow rate of the metallic fumes which tune the flow rate of metallic fumes finely further, and are supplied to the band material vacuum evaporationo section can be adjusted still more minutely. Consequently, it becomes possible to carry out the vacuum evaporationo of the metal coat of the necessary thickness whose thickness was further fixed to band material, and it can improve the quality further.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Drawing of longitudinal section of the vacuum evaporation system concerning the 1st example of this invention.
[Drawing 2] Drawing of longitudinal section to which the rotary shutter unit in drawing 1 was expanded.
[Drawing 3] III-III of drawing 2 **** view.
[Drawing 4] Operation explanatory drawing of a rotary shutter unit.
[Drawing 5] The diagram showing the rate of a flow rate of the angle of rotation of a shutter shaft, and metallic fumes by experiment.
[Drawing 6] The profile of the rotary shutter unit in the vacuum evaporation system concerning the 2nd example of this invention.
[Drawing 7] VII-VII in drawing 6 View view.
[Drawing 8] Drawing of longitudinal section of the conventional vacuum evaporation system.
[Description of Notations]
1 11 Shutter block
1d, 11d Steamy circulation hole
2 Shutter Shaft
2a, 2b, 2c, 2d Flow control hole
10 20 Rotary shutter unit
40 Molten Metal
40a Metallic fumes
41 Evaporation Side
50 Band Steel
51 Crucible
52 Induction Heater
55 Supply Way
56 Vacuum Evaporationo Way
56a Opening
61 Vacuum Chamber
theta Angle of rotation

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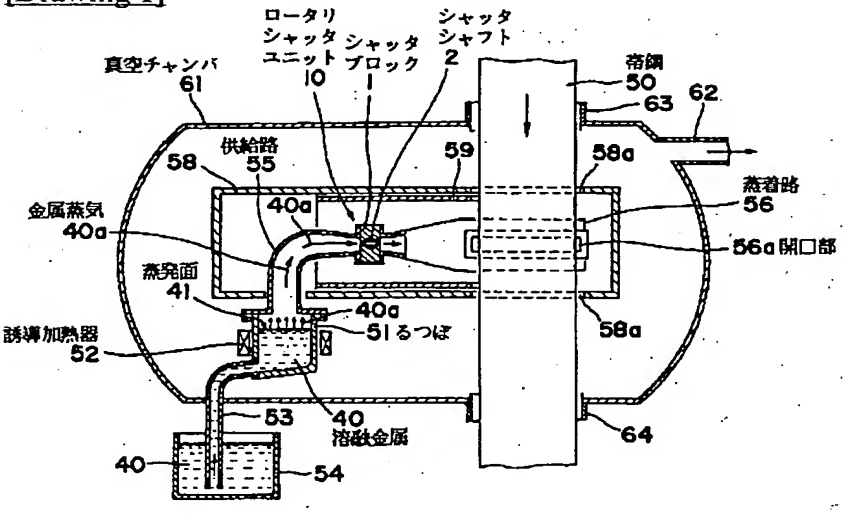
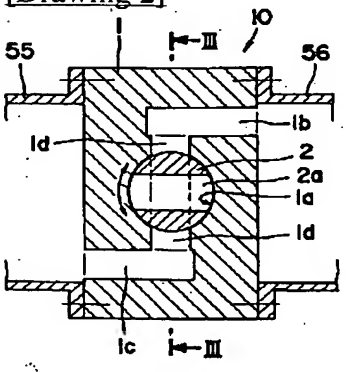
DRAWINGS

[Drawing 1]



[Drawing 2]



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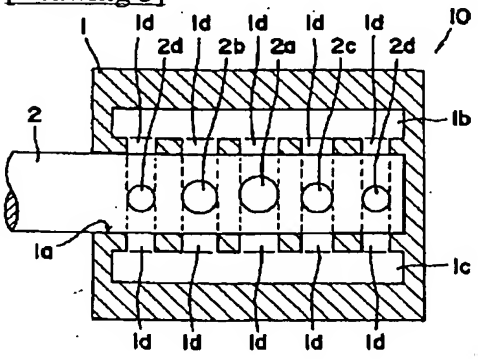

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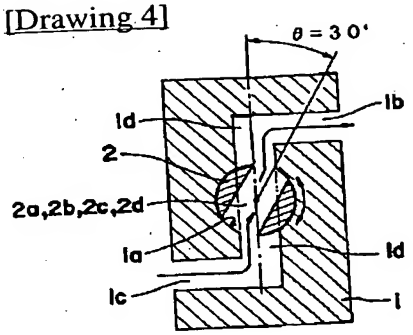

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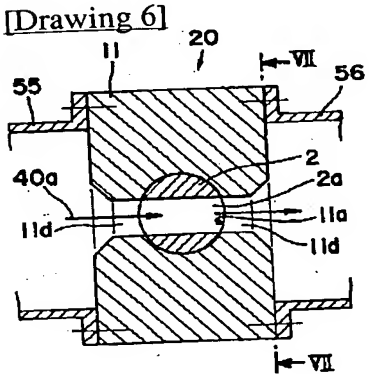
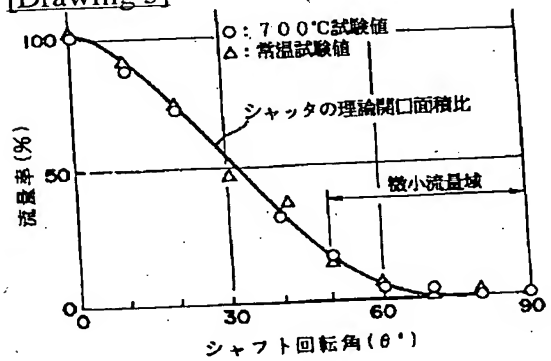
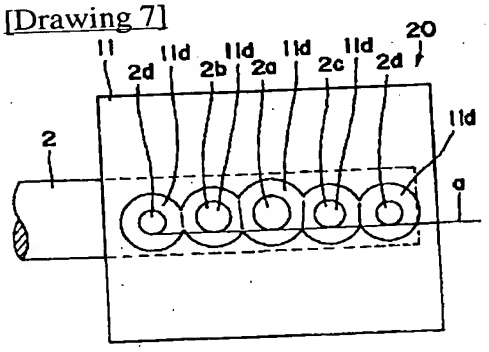


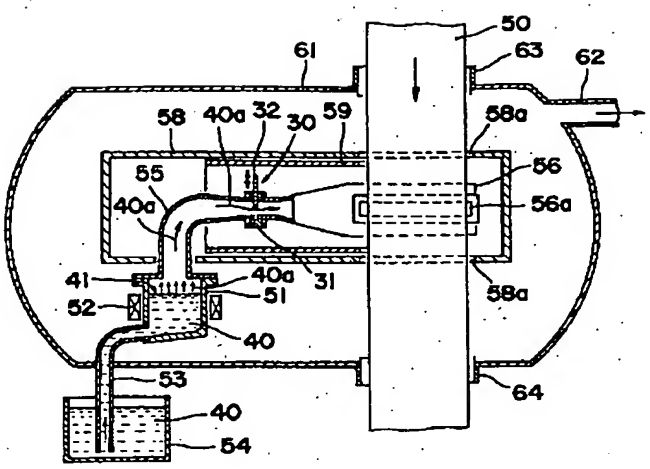
[Drawing 5]



[Drawing 7]



[Drawing 8]



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